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AUTHOR Lacina, Lorna J.
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ABSTRACT

Questionnaires were sent to 97 computer coordinators in school districts in Texas and 59 program directors in colleges of education throughout the United States to determine: (1) the computer knowledge and skills that school district computer coordinators perceive to be needed by classroom teachers; (2) the computer knowledge and skills that college program directors perceive to be needed by classroom teachers; and (3) whether school district computer coordinators and college program directors have different perceptions of the essential computer competencies needed by classroom teachers. Questionnaires were returned by 88 computer coordinators and 51 program directors. Analyses of their responses indicate that both school district coordinators and college program directors perceive that the competency to evaluate and choose quality software is very important for teachers; the ability to use the computer as an instructional tool in such modes as drill and practice, tutorials, simulations, and problem solving is considered very important by computer coordinators and important by program directors; and the competencies associated with programming and the history of computers are considered moderately important by both groups. The remaining competencies associated with computers and society are considered important by both groups: ethical concerns, record keeping, care of hardware, care of software, word processing, and data processing. The report concludes with a list of 12 competencies to be included in computer education coursework for preservice and inservice teachers, a 13-item list of objectives and supporting text references and lab activities for a suggested computer literacy course for teachers, 4 tables of survey data, a bibliography for the course, and a list of references. (JB)

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THE DETERMINATION OF COMPUTER COMPETENCIES NEEDED BY CLASSROOM TEACHERS

ED264831

Lorna J. Lacina, Ed.D.
Assistant Professor of Education
Loras College
Dubuque, Iowa 52001

Formerly:

Teaching Assistant
Educational Curriculum and Instruction
Texas A&M University
College Station, Texas 77843

Current Address:

Loras College
1450 Alta Vista
Dubuque, Iowa 52001
(319) 588-7796 or 588-7157

IR011915

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ABSTRACT

The Determination of Computer Competencies Needed by Classroom Teachers

Computers have become an indispensable part of our society. The impact of computers has been so great that state agencies are working to ensure that schools under their auspices are prepared for the age of computers. To illustrate, in 1984 the Texas legislature mandated computer literacy coursework for students attending public schools. Graduation requirements have been revised to include computing requirements for the advanced high school program. Teacher certification requirements have also been revised to include computer literacy as part of the academic foundations coursework.

Questionnaires were sent to 97 computer coordinators in school districts in Texas and 59 program directors in colleges of education throughout the United States. Eighty-eight computer coordinators and 51 program directors participated in this study.

The first research question of this investigation sought to determine the computer knowledge and skills that school district computer coordinators perceive to be needed by classroom teachers. The second research question dealt with identifying the computer knowledge and skills that college program directors perceive to be needed by classroom

teachers. And, the final research question sought to determine whether differences in perceptions among school district computer coordinators and college program directors occur regarding essential computer competencies needed by classroom teachers.

INTRODUCTION

Computers have become an integral part of our society. The impact of computers has been so great that state agencies are working to ensure that schools under their tutelage are prepared for the age of computers. Forty-seven states have advocated the instructional applications of computers and computer literacy coursework for their students (Christen & Gladstone, 1983). To illustrate, in 1984 the Texas legislature mandated computer literacy coursework for students attending public schools. Graduation requirements have been revised to include computing requirements for the advanced high school program. Teacher certification requirements have also been revised to include computer literacy as part of the academic foundations coursework.

The purpose of this study was to identify the competencies needed by teachers to implement computer technology in their classrooms as determined by perceptions of need by school district computer coordinators in Texas and college program directors in the United States.

The study followed the design method elaborated in Dillman (1978). Questionnaires were sent to 97 computer coordinators in school districts in Texas and 59 program directors in colleges of education throughout the United States. Eighty-eight computer coordinators and 51 program directors participated in this study.

The first research question of this investigation

sought to determine the computer knowledge and skills that school district computer coordinators perceive to be needed by classroom teachers. The second research question dealt with identifying the computer knowledge and skills that college program directors perceive to be needed by classroom teachers. And, the final research question sought to determine whether differences in perceptions among school district computer coordinators and college program directors occur regarding essential computer knowledges and skills needed by classroom teachers.

ORGANIZATION OF INVESTIGATION

Program Description

This study followed the design model elaborated in Dillman (1978). The Total Design Method (TDM) mail survey was developed with "the realization that virtually any step in the process of sending and retrieving questionnaires may produce a refusal" (Dillman, 1978, p. 161). The appeal of this method is based on convincing people that a problem exists that is of importance to them and that their help is needed to find a solution. The Total Design Method was modified to include one follow-up instead of three follow-ups for nonrespondents.

Data for this study were collected from questionnaires sent to computer coordinators in school districts and program directors in colleges of education. The first section of the questionnaire requested demographic

information. This information included: the number of years of instructional computer use by the school district or institution; the position of the respondent; and the programming languages in which the respondent was proficient. The second section of the questionnaire served to rate the degree of importance of the computer knowledge and skills needed by classroom teachers. Both computer coordinators and program directors responded on the same form of the questionnaire.

METHODOLOGY

Sample

The sample for this study was limited to program directors in colleges of education in the United States offering computers in education courses and computer coordinators in independent school districts in Texas offering computers in instructional programs. The questionnaire was sent to 59 program directors and 97 computer coordinators.

First, program directors in colleges of education offering computers in education courses were selected to participate in this study. The program directors were identified through the results of a survey in the March 1983 issue of The Computing Teacher. The purpose of the survey was to identify the institutions offering computers in education courses during the 1983 summer session. To compile this list, a form was sent to all United States and

Canadian colleges and universities. The sample for this study was limited to those program directors in colleges of education in the United States. The program directors come from institutions, both public and private, that vary in scope from 4-year colleges to major research universities and in orientation from liberal arts to technical education.

Second, computer coordinators in independent school districts were chosen through a nomination process to participate in this study. To obtain this sample, the director of each region center in Texas was asked to nominate the top 5 school districts offering computers in instructional programs in their region. All region directors participated in this nomination process. The nomination and selection procedures for this study should have yielded the true experts in this field (Borg & Gall, 1979, p. 188). The nominated public school districts vary in size from 200 to 194,000 students and occur in settings from rural to urban.

Instrumentation

A questionnaire was developed specifically for the data collection activities of this study. Development of this instrument followed the design model elaborated in Dillman (1978). The questionnaire consisted of two major sections. The first section requested demographic data. The second section consisted of a series of statements dealing with computer knowledge and skills needed by teachers. The respondents were asked to rate these statements on a Likert

type scale. The categories ranged from not important to very important. The first section provided nominal data while the second section provided ordinal data.

The initial questionnaire consisted of 24 statements dealing with computer knowledge and skills to be rated by the respondents as to their perceived importance. These skills had been found to be essential for teachers by experts in the field (Bass, Brown, & Nold, 1975; Billings, 1983; Brooks, 1971; Henderson, 1978; Milner, 1980; Moursund, 1980; Podemski, 1981; Poirot, Taylor, & Powell, 1983; Rawitsch, 1983). Each skill was classified into one of three categories, instructional applications, administrative applications, or research applications.

The initial questionnaire was reviewed by a panel of judges to determine whether the questionnaire would accomplish the study objectives. After careful examination of the items, four items were eliminated because they were thought not to be related to the duties of classroom teachers. Further, instructions were reworded to provide clarity and an additional question was added to request the programming languages in which the respondent was proficient.

The questionnaire was submitted to 53 school personnel in the Bryan Independent School District. The participants were elementary and secondary teachers and administrators currently using computers in their classrooms or trained in the use of computers for instructional purposes. They were directed to attend in particular to content, clarity of

instructions, and ease of response. The only modification resulting from this pilot test was an enlargement of the print size.

ANALYSIS AND FINDINGS

Data were treated descriptively for this study. First, frequencies and percentages were used to report the data in section one of the questionnaire. Second, the mean and standard deviation of the Likert type response for each or the items were reported. Third, differences in perceptions between computer coordinators in school districts and program directors in colleges of education were made through the use of parametric inferential statistical methods.

Question One - Participating computer coordinators were asked to rate the degree of importance of some twenty computer related concepts or skills needed by teachers. A summary of these ratings are found in Table 1. The table reveals that two items received a mean rating of higher than 4.5. These two items, evaluation of software for instructional purposes and computer-assisted instruction, were considered very important computer skills for teachers. Fourteen items received a rating between 3.5 and 4.5 and were considered important content and skills for teachers. These items are care of software, care of hardware, evaluation of software for administrative purposes, ethical concerns related to administrative records, record keeping for instructional purposes, access to student records for administrative purposes, computers and society, word

processing for instructional purposes, word processing for administrative purposes, data processing in research, ethical concerns related to research applications, social and ethical concerns related to the use of computers in society, evaluation of hardware for instructional purposes, and evaluation of hardware for adminstrative purposes. Four items received a rating between 2.5 and 3.5. These items, programming for research purposes, programming for instructional purposes, programming for administrative purposes, and history of computers, were considered moderately important skills for teachers.

Question Two - Participating program directors were asked to rate the degree of importance of some twenty computer related skills needed by teachers. A summary of these ratings are found in Table 2. This table reveals that one item received a mean rating of higher than 4.5. This item, evaluation of software for instructional purposes, was considered a very important computer skill for teachers. Thirteen items received a rating between 3.5 and 4.5 and were considered important content and skills for teachers. These items are computer-assisted instruction, ethical concerns related to administrative records, social and ethical concerns related to the use of computers in society, care of software, computers and society, word processing for instructional purposes, record keeping for instructional purposes, word processing for administrative purposes, ethical concerns related to research applications, access to student records for administrative purposes, data processing

in research, care of hardware, and evaluation of software for administrative purposes. And, the remaining six items received a rating between 2.5 and 3.5. These items were evaluation of hardware for instructional purposes, programming for instructional purposes, evaluation of hardware for administrative purposes, programming for research purposes, history of computers, and programming for administrative purposes and are considered moderately important for teachers.

Question Three - The final question addressed by this study sought to determine whether differences in perceptions of school district computer coordinators and college program directors occur regarding the computer knowledge and skills needed by classroom teachers. Data were reported to show the relationship between computer coordinator and program director responses. These data revealed commonalities among the perceived types of computer knowledge and skills needed by classroom teachers.

A relative comparison among the mean scores of school district computer coordinators and college program directors is shown in Table 3. Seventeen items received higher mean ratings by school district computer coordinators and eight ratings were found to be significantly different from one another. Without exception, these items were considered of greater importance by school district computer coordinators.

A further examination of the data revealed that computer coordinators and program directors agree on the relative importance of seventeen of the items. This

information is presented in Table 4. Both samples agree that one item was considered very important (VI), twelve items were considered important (I), and four items were considered moderately important (MI). The one item considered very important by both samples is evaluation of software for instructional purposes. Only one item, computer-assisted instruction, was considered very important by computer coordinators and important by program directors. And, two items were perceived as important by computer coordinators and moderately important by program directors. These items are evaluation of hardware for instructional purposes and evaluation of hardware for administrative purposes.

DISCUSSION

Although restricted to present conditions, the results reflect a need for classroom teachers to become computer literate. This is consistent with the views noted in the literature (Bass et al., 1975; Billings, 1983; Brooks, 1971; Bruwelheide, 1982; Henderson, 1978; Milner, 1980; Moursund, 1980; Podemski, 1981; Poirot et al., 1983; Rawitsch, 1983). This study served to identify the computer competencies perceived to be needed by classroom teachers.

School district computer coordinators and college program directors agreed that the competency, to evaluate and choose quality software, was very important for teachers. A second competency, to use the computer as an instructional tool in such modes as drill and practice,

tutorial, simulation, and problem solving, was considered very important by computer coordinators and important by program directors. These two competencies have also been reported to be of importance by others (Billings, 1983; Brooks, 1971; Milner, 1980; Moursund, 1980; Podemski, 1981; Poirot et al., 1983; Rawitsch, 1983). The competencies associated with programming and history of computers were considered moderately important by both computer coordinators and program directors. Conversely, the competency, to read, write, and modify programs and to understand the theory and process of programming, was consistently mentioned in the literature as an important competency for teachers (Bass et al., 1975; Milner, 1980; Moursund, 1980; Poirot et al., 1983; Rawitsch, 1983). In addition, the competency, to understand the historical development of computers and computers in education, has been considered to be of importance given the related literature (Moursund, 1980; Poirot et al., 1983). The competency, to evaluate and choose an effective computer system, was considered important by computer coordinators and moderately important by program directors. Bass et al. (1975) considers this competency as essential for teachers. And, the remaining competencies associated with computers and society, ethical concerns, record keeping, care of hardware, care of software, word processing, and data processing were considered important by both computer coordinators and program directors. These competencies are consistently mentioned as important topics in the literature

(Bass et al., 1975; Billings, 1981; Brooks, 1971; Bruwelheide, 1982; Henderson, 1978; Milner, 1980; Moursund, 1980; Podemski, 1981; Poirot et al., 1983; Rawitsch, 1983).

The findings of this survey indicate a need for teachers to become computer literate. This is consistent with the current views regarding the computer competencies needed by teachers reported in the literature. Inservice education should be provided to teachers currently in the schools. And, additional computer skills/knowledge will need to be provided to preservice and inservice teachers as changes in computers and related technology occur.

Recommendations

It is recommended that the following competencies be included in computer education coursework for preservice and inservice teachers.

(1) to understand the historical development of computers and computers in education.

(2) to understand how computers are used in society.

(3) to understand the legal and ethical implications related to the use of computers in society, such as piracy and access to confidential information.

(4) to use the computer as an instructional tool in such modes as drill and practice, tutorial, simulation, and problem solving.

(5) to understand how a computer can be used to store student records and ability to gain access to such records.

(6) to understand the care and proper handing of hardware.

(7) to understand the care and proper handling of software.

(8) to evaluate and choose an effective computer system.

(9) to evaluate and choose quality software.

(10) to use the computer as a word processing instrument.

(11) to read, write, and modify programs and to understand the theory and process of programming.

(12) to use the computer as a data processing instrument.

School district computer coordinators consistently rated 17 of the 20 computer concepts and skills associated with the competencies of greater importance than the college program directors. Since it appears that computer coordinators were not as discrimatory in their ratings, it is suggested that further study be conducted to identify the most important computer concepts and skills needed by classroom teachers. This may best be accomplished by having the items rank ordered according to their perceived degree of importance.

Due to the constantly changing nature of computers and related technology, it is recommended that professional education coursework be continually monitored to reflect these changes. The following course syllabus is suggested as a framework for a computer education course for preservice and inservice teachers.

Computer Literacy for Teachers

Textbook

Hofmeister, A. (1984). Microcomputer applications in the classroom. New York: Holt, Rinehart and Winston.

Course Rationale

Computers have become an indispensable part of our technological society. Computers have made tasks once considered virtually impossible now attainable. The technology has created new jobs while at the same time making other jobs obsolete. This phenomenon has placed a demand on education to provide new skills and training. The ability to use a computer has become a basic survival skill in an information society. Schools must help prepare the future generations for this technological society. The effective and widespread use of computers depends on the preparation and training of teachers.

This course seeks to provide the content and skills necessary for teachers to use effectively computers in their classrooms. Teachers can thus transmit this literacy to their students, to parents, and ultimately to society.

Course Requirements

The course's requirements are listed in the form of performance objectives. These objectives will provide guidance to maintain focus during the course. There are two sections of objectives: those dealing with work to be accomplished during the course and those dealing with the work designed for the lab activities.

Performance Objectives

The Computer Literacy student will be able to:

(1) identify important events in the historical development of computers and computers in education by correctly responding to 8 of 10 multiple choice items on a progress test.

(2) identify and describe how computers are used in society by correctly responding to 8 of 10 multiple choice items on a progress test.

(3) describe the legal and ethical implications related to the use of computers in society, such as piracy and access to confidential information by successfully responding to an essay item on a progress test.

(4) write and print a paper using the computer as a word processing instrument. This objective will be achieved by successfully completing a lab activity.

(5) demonstrate the use of the computer as an instructional tool in such modes as drill and practice, tutorial, simulation, and problem solving. This objective will be achieved by successfully completing a lab activity.

(6) describe how a computer can be used to store student records by correctly responding to an essay item on a progress test.

(7) demonstrate how to gain access to student records by successfully completing a lab activity.

(8) discuss the theory and process of programming by successfully responding to an essay item on the final exam.

(9) recognize the care and proper handling of software by correctly responding to 8 of 10 multiple choice items on the final exam.

(10) evaluate and choose quality software by successfully completing a software evaluation form as part of a lab activity.

(11) recognize the care and proper handling of hardware by correctly responding to 8 of 10 multiple choice items on the final exam.

(12) evaluate and choose an effective computer system by correctly responding to an essay item on the final exam.

(13) read, write, and modify programs by successfully completing a lab activity.

(14) use the computer as a data processing instrument on a given set of data as part of a lab activity.

Schedule

Class	Objective	Related Reading	Lab Activity
1	1	Chapter 1	Introduction
2	2,3	Chapter 2	Word Processing
3	4	Chapter 2	Word Processing
4	5	Chapters 3-4	Applications
5	6	Chapter 5	Applications
6	7	Chapter 5	Record Keeping
7	8	Chapter 6	Record Keeping
8	Progress Test (Objectives 1-3,6)		
9	9	Chapter 7	Software
10	10	Chapter 7	Software
11	11	Chapter 8	Programming
12	12	Chapter 8	Programming
13	13	Chapter 9	Data Processing
14	14	Chapter 10	Data Processing
15	Final Exam (Objectives 8,9,11,12)		

Course References

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Selected Journals

AEDS Journal

BYTE

Classroom Computer Learning

The Computing Teacher

Creative Computing

Educational Technology

Electronic Learning

Instructional Innovator

Theory Into Practice

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Rawitsch, D. G. (1983). Teaching educators about computing: A different ball game. In D. O. Harper & J. H. Stewart (Eds.), RUN: Computer education (pp. 97-102). Monterey, CA: Brooks/Cole.

TABLE 1

Mean Scores and Standard Deviations of Ratings by School District Computer Coordinators

	Item	Mean Scores	Standard Deviation
A	Instructional Applications		
1	History of Computers	2.69	1.03
2	Computers and Society	4.01	0.97
3	Social and Ethical Concerns	3.86	0.93
4	Computer-Assisted Instruction	4.56	0.73
5	Record Keeping	4.03	0.84
6	Care of Hardware	4.18	0.88
7	Care of Software	4.44	0.68
8	Evaluation of Hardware	3.68	1.08
9	Evaluation of Software	4.59	0.64
10	Programming	3.09	1.17
11	Word Processing	3.92	0.88
B	Administrative Applications		
1	Student Records	4.02	0.90
2	Ethical Concerns	4.06	0.88
3	Evaluation of Hardware	3.63	1.13
4	Evaluation of Software	4.09	1.14
5	Word Processing	3.91	1.01
6	Programming	2.69	1.13
C	Research Applications		
1	Ethical Concerns	3.87	1.04
2	Data Processing	3.90	0.94
3	Programming	3.19	1.26

N = 88

TABLE 2

Mean Scores and Standard Deviations of Ratings by College of Education Program Directors

	Item	Mean Scores	Standard Deviation
A	Instructional Applications		
1	History of Computers	2.55	1.03
2	Computers and Society	3.86	0.90
3	Social and Ethical Concerns	3.96	1.02
4	Computer-Assisted Instruction	4.47	0.83
5	Record Keeping	3.80	0.85
6	Care of Hardware	3.59	1.02
7	Care of Software	3.88	0.91
8	Evaluation of Hardware	3.18	1.01
9	Evaluation of Software	4.63	0.60
10	Programming	3.06	1.14
11	Word Processing	3.84	1.07
B	Administrative Applications		
1	Student Records	3.69	0.99
2	Ethical Concerns	4.10	0.96
3	Evaluation of Hardware	2.96	1.18
4	Evaluation of Software	3.59	1.28
5	Word Processing	3.73	1.30
6	Programming	2.53	1.05
C	Research Applications		
1	Ethical Concerns	3.70	1.31
2	Data Processing	3.63	1.27
3	Programming	2.80	1.44

N = 51

TABLE 3

Comparison of Ratings Between
Computer Coordinators and Program Directors

	Item	School Means	College Means	T-Value
A	Instructional Applications			
1	History of Computers	2.69	2.55	0.90
2	Computers and Society	4.01	3.86	0.55
3	Social and Ethical Concerns	3.86	3.96	-1.13
4	Computer-Assisted Instruction	4.56	4.47	1.29
5	Record Keeping	4.03	3.80	1.03
6	Care of Hardware	4.18	3.59	3.21 *
7	Care of Software	4.44	3.88	3.36 *
8	Evaluation of Hardware	3.68	3.18	3.19 *
9	Evaluation of Software	4.59	4.63	-0.34
10	Programming	3.09	3.06	0.61
11	Word Processing	3.92	3.84	0.00
B	Administrative Applications			
1	Student Records	4.02	3.69	2.29 *
2	Ethical Concerns	4.06	4.10	-0.11
3	Evaluation of Hardware	3.63	2.96	3.03 *
4	Evaluation of Software	4.09	3.59	2.04 *
5	Word Processing	3.91	3.73	1.23
6	Programming	2.69	2.53	1.54
C	Research Applications			
1	Ethical Concerns	3.87	3.70	0.37
2	Data Processing	3.90	3.63	2.07 *
3	Programming	3.19	2.80	1.75 *

df = 96
* Significance at the .05 level, Schools > Colleges

TABLE 4

Comparison of Item Importance Between
Computer Coordinators and Program Directors

	Item	Schools	Colleges
A	Instructional Applications		
1	History of Computers	MI	MI
2	Computers and Society	I	I
3	Social and Ethical Concerns	I	I
4	Computer-Assisted Instruction	VI	I
5	Record Keeping	I	I
6	Care of Hardware	I	I
7	Care of Software	I	I
8	Evaluation of Hardware	I	MI
9	Evaluation of Software	VI	VI
10	Programming	MI	MI
11	Word Processing	I	I
B	Administrative Applications		
1	Student Records	I	I
2	Ethical Concerns	I	I
3	Evaluation of Hardware	I	MI
4	Evaluation of Software	I	I
5	Word Processing	I	I
6	Programming	MI	MI
C	Research Applications		
1	Ethical Concerns	I	I
2	Data Processing	I	I
3	Programming	MI	MI

VI - Very Important (item means ranging from 4.50 - 5.00)
I - Important (item means ranging from 3.50 - 4.49)
MI - Moderately Important (item means ranging from 2.50 - 3.49)